Executive Order #511
Confined Space Entry
Summary of Standards and Recommendations

This summary of standards was prepared by the Massachusetts Department of Labor Standards ("DLS") for informational purposes and does not constitute an official interpretation by OSHA or any other agencies/entities listed as a source of standards or guidance in this document, nor an exhaustive recitation of the requirements therein. Rather, the summary is provided for the health and safety committees to assess current health and safety management of this hazard against the nationally-recognized standard. As the information provided in this document is only a summary, please consult the full standard(s) as well as any other needed sources of technical assistance for developing or improving your confined space entry program.

It is important to note that state workers are not covered by OSHA standards; the information generated by the health and safety committees will serve to guide the Massachusetts Employee Safety and Health Advisory Committee in identifying effective and practical strategies and policies for improving the health and safety of state workers.

Technical Standard or Guideline*:

OSHA 29 CFR 1910.146, Permit-Required Confined Spaces

**This is the primary national or state standard/guideline for this hazard. Your agency may be following an internal standard of practice or a standard from another source for this hazard. For the gap analysis, if you are following a standard other than the primary worker protection standard listed above, please indicate which standard, if any, is being followed by your agency. If this is an internal standard of practice, please report the basis upon which the determination was made to adopt the standard.*

Highlights of the Standard:

A **confined space** is defined as:

1. Large enough and so configured that an employee can bodily enter and perform assigned work.
2. Has limited or restricted means for entry or exit (i.e., ladder or spiral staircase access versus a standard staircase). Examples include: tanks, vessels, silos, storage bins, hoppers, vaults, pits, and manholes.

3. Is not designed for continuous employee occupancy.

A **permit-required confined space** (permit space) has one or more of the following additional characteristics:

1. Contains or has the potential to contain a hazardous atmosphere.
2. Contains material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
4. Contains any other recognized serious safety or health hazard.

Only permit-required confined spaces are regulated by this standard.

Employers must identify all of their permit-required confined spaces, and post danger signs on these spaces. If the employer does not plan to have employees enter these spaces, effective measures must be taken to prevent entry.

As an overview, the general principles of safe permit-required confined space entry are below.

- Know where you have permit spaces and know the hazards present with each permit space.
- Control/block/mitigate the potential hazards in these spaces prior to an employee entering the space and throughout the time of entry. (For example by lockout/tagout of moving parts or ventilation to correct a hazardous atmosphere).
- Continually monitor the space to ensure that hazards are controlled throughout the time of entry (for example, continual air monitoring).
- From outside the space, have attendants carefully monitor the employees who have entered the space (entrants) and the condition in the space throughout the time of entry.
- Have an emergency plan to promptly rescue entrants if they come to harm in the space. This may include use of remote retrieval systems as you do not want to send additional employees into the space, which now puts them at risk too.

More detail on the specifics in the OSHA standard are given starting in the paragraph below and throughout the remainder of this document.

If employees will enter any permit-required confined spaces, employers must:

- Develop a written confined space program, which includes entry procedures, duties of entrants and attendants, and provisions for use of written entry permits.
- Provide and ensure use of necessary equipment including:
    - **Air testing and monitoring equipment** to evaluate the atmosphere in the space

  - **Ventilation equipment** such as continuous forced air ventilation to mitigate the hazardous atmosphere during the period of entry
  - **Retrieval systems** to allow for non-entry rescue of persons from the confined space (such as a tripod/winch/harness system)
  - **Communications equipment**
  - Other equipment as needed including personal protective equipment, lighting, ladders, etc.
- Train employees so that they are proficient in the knowledge and skills to safely perform all duties associated with permit confined spaces.

If it is only a hazardous atmosphere that makes a space a permit confined space, and this atmosphere can be made fully safe during the time of entry using ventilation, and this can be documented, then a one person entry is allowed. This is called "alternate procedures" in the OSHA standard, and when these alternate procedures are allowed, the full procedures required under the permit confined space plan do not need to be followed. Documented air monitoring is still required under alternate procedures.

Visiting Personnel
If personnel will enter permit spaces at another employer's location, both the host employer and visitor employer must coordinate in advance to ensure that the entry will be conducted in accordance with permit space program requirements.

- The **host employer** must:
  - provide information to the visitor employer on:
    - the presence of permit spaces,
    - the hazards identified for those spaces,
    - precautions or procedures that have been implemented for the protection of employees entering or working near those spaces.
  - Coordinate entry operations with the visitor employer when both host and visiting personnel will be working in or near permit spaces.
- The **visitor employer** must:
  - Comply with permit space requirements that apply to all employers (e.g., the OSHA standard).
  - Obtain information from the host employer regarding permit space hazards and entry operations at their facility.
  - Coordinate entry operations with the host employer when both host and visiting personnel will be working in or near permit spaces.
  - Inform the host employer of the permit space program that the visiting personnel will follow.
  - Inform the host employer of any hazards confronted or created in permit spaces. This may be through a debriefing following the entry.

Policy / Written Program:

A written permit space program must be developed and implemented if employees will enter permit spaces. Program elements include:

- Measures to prevent unauthorized entries.
- Identification and evaluation of permit space hazards before any entries occur (details on permits are discussed in the administrative controls section below).
- Procedures for permit space entry, including:
    - Specifying acceptable entry conditions.
    - Providing entrants with the opportunity to observe air monitoring or other testing of the space.
    - Isolating the space. This means removing the space from service, and completely protecting the space from release of energy or material into the space through means such as lockout/tagout, full closure of pipes/lines with solid plates (blanking or blinding), closing two in-line valves then draining interim line/pipe (double block and bleed), disconnecting mechanical linkages, etc.
    - Purging, inerting, flushing or ventilating the permit space as necessary to eliminate or control atmospheric hazards.
    - Providing pedestrian, vehicle, or other barriers to protect entrants from external hazards.
    - Verifying that conditions in the permit space are acceptable throughout the period of entry (for example by continual periodic air monitoring.
    - Providing and ensuring use of needed equipment such as air monitors, retrieval systems, communication devices, ventilation, etc. (outlined in the Equipment Controls section below).

Developing written entry procedures is recommended for individual permit confined spaces that are more complex and hazardous than a typical permit confined space, for example with a horizontal descent followed by vertical travel within the permit space. The entry supervisor will still set the conditions for each entry on the permit, whether or not written entry procedures have been developed.

Training and Certification/Licensing Requirements:

All employees who have work associated with permit spaces must be trained so that they have the knowledge and skills needed for the safe performance of duties outlined under the OSHA standard on permit spaces.

Employee proficiency in the safe performance of these duties is required as part of the training.

Training must occur prior to the employee performing any duties associated with confined spaces.

This training must be certified by documenting the employee's name, signature or initials of the trainer, and date of training.

Those who will enter permit spaces (**entrants**) must be proficient in the following duties:

- Know the hazards that may be faced during entry.
- Properly use all assigned equipment (such as air monitors, communication devices, remote retrieval systems).
- Communicate with the attendant.
- Alert the attendant when there is a warning sign or symptom of a hazard or dangerous condition.
- Exit the permit space when there is a warning sign or symptom of a hazard or dangerous condition or as instructed by the attendant.

Those who will serve as outside **attendants** during entries must be proficient in the following duties:

- Know the hazards that may be faced during entry.
- Understand and recognize possible behavioral effects of hazard exposure in entrants (for example symptoms of insufficient oxygen).
- Continuously maintain an accurate count of authorized entrants in the permit space.
- Remain outside the space for the duration of the entry.
- Communicate with authorized entrants as necessary to monitor their status and alert them if there is a need to evacuate.
- Monitor activities and conditions inside and outside the space to determine if entrants can safety remain in the space.
- Summon rescue and emergency services when assistance may be needed for entrants to escape the permit space.
- Perform non-entry rescues as specified by the employer's rescue procedure.

Those who will serve as **entry supervisors** must be proficient in the following duties:

- Know the hazards that will be faced during entries.
- Verify that all entries have been made on the written permit, and that all procedures and equipment specified by the permit are in place prior to allowing entry to begin.

- Terminate the entry and cancel the permit when the entry operations are completed or when unacceptable entry conditions arise.
- Remove unauthorized individuals who enter or attempt to enter the permit space during entry operations.
- Determines throughout the time of entry that operations remain consistent with the terms of the entry permit.

Administrative Controls – Requirements:

Identification of Permit Spaces: The employer must evaluate the full workplace to identify any permit spaces so that required entry procedures can be implemented.

Danger Signs: Identified permit spaces must be posted with the following or equivalent:

DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER

Entry Prevention: If the employer plan is that employees will not enter permit spaces, the employer shall take effective measures, such as locking the area, to prevent employees from entering these spaces.

Permits: A written entry permit system is required prior to each entry to ensure and document that all necessary safety measures are taken prior to an entry. The entry permit shall identify the specifics for this entry, including:

1. The permit space to be entered.
2. The purpose of the entry.
3. The date and authorized duration of the entry.
4. The authorized entrants.
5. The names of personnel serving as attendants.
6. The name of the entry supervisor.
7. The hazards of the permit space.
8. The measures used to isolate the permit space and to eliminate or control hazards in this space before entry.
9. The acceptable entry conditions.
10. The results of initial and periodic tests (such as air monitoring data).
11. The qualified rescue and emergency services that can be summoned and the numbers to call them.
12. The communication procedures to be used between entrants and attendants to maintain contact during the entry.

13. Required equipment provided for this entry, including personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment.
14. Any other necessary information.
15. Any additional permits for the entry, such as hot work permits (required for operations capable of producing a source of ignition, such as riveting, welding, cutting, burning, and heating.

Attendants: At least one attendant must be in place outside of the permit space for the duration of entry operations. The attendant must be in constant awareness of the conditions in the permit space and must be in constant communication with entrants. If an attendant can effectively perform the needed duties for more than one permit space simultaneously, this attendant can be assigned to monitor these multiple permit spaces. He may need to order evacuation of the space, perform non-entry rescues, or summon emergency and rescue services if a problem occurs. The detailed duties of the attendant are outlined in the training section above.

Entry Supervisors: An entry supervisor must be in place for each entry. This person will ensure that all safety measures as outlined on the entry permit (e.g., air monitoring, use of retrieval systems, etc.) are met before entry occurs. This person will also ensure and that acceptable entry conditions are in place throughout entry operations or terminate the entry when an unacceptable condition arises. Note that the entry supervisor may also perform duty as the attendant.

Engineering and Equipment Controls – Requirements:

Air monitors:
Permit spaces must be evaluated for a hazardous atmosphere. A hazardous atmosphere is defined in the standard as:

1. Flammable gas or vapor that exceeds 10% of its lower flammable limit (LFL). (Note: you may see this term given as the lower explosive limit (LEL).
2. Airborne combustible dust at a concentration that meets or exceeds its LFL. (This can be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less).
3. An atmospheric oxygen concentration below 19.5% or above 23.5%.
4. An atmospheric concentration of any substance that exceeds the OSHA permissible exposure limit (PEL) for this substance.
5. Any other atmospheric condition that is immediately dangerous to life or health.

Air monitors must be sensitive enough to be able to test for the hazardous atmospheric conditions outlined above. They must also be able to test for the specific gases or conditions of concern in the space. A 4-gas monitor is typically used to evaluate the

atmosphere in confined spaces. This tests for levels of oxygen, flammable gases, carbon monoxide, and an optional fourth gas, typically hydrogen sulfide which is a toxic gas prevalent in sewers. Use and monitoring requirements include:

- These monitors need to be calibrated periodically in accordance with manufacturer's instructions.
- They should also be field calibrated or "bump tested" immediately prior to use, by placing a gas of known concentration on the monitor and ensuring it is within specifications.
- Testing must include evaluating every 4 feet in all three dimensions (length, width, and depth). Think of a three dimensional linear grid with bars spaced 4 feet apart. Testing would occur at all points of intersection.
- Testing with direct read instruments is required. Testing for oxygen, flammable gases, and potential toxic air contaminants must occur and be conducted in that order.
- Testing must occur for the duration of at least the minimum response time of the instrument as given by the manufacturer.
- Testing must occur prior to entry.
- If a hazardous atmosphere is identified, and continuous forced air ventilation is used, testing must occur to ensure that the ventilation is effectively eliminating the atmospheric hazard.
- Continual re-testing must occur throughout the time of entry to ensure that the hazardous atmosphere is being successfully controlled. It is recommended that entrants wear gas monitors equipped with sound alarms which go off when an a level approaches a certain percentage of an atmospheric hazard of concern.

Continuous forced air ventilation must be used when there is a hazardous atmosphere. The continuous forced air ventilation must successfully eliminate the hazardous atmosphere before an entry can occur.

- The air supply for the forced air ventilation must be from a clean source. As such, the air intake must be located outside the permit space. The air intake should be positioned away from air contaminants, for example, positioned away from sources of vehicle exhaust such as tailpipes.
- The ventilation hose shall be directed to ventilate the immediate area within the permit space where employees will be located.
- The ventilation must continue until all employees have left the permit space.

Retrieval Systems: are the equipment used for non-entry rescues. This may include a retrieval line, full-body harness, wristlets if appropriate, and a lifting device or anchor. A tripod/winch/harness system or davit arm/winch/harness are common retrieval systems. Use of retrieval systems is recommended for all permit space entries in order to eliminate

the need for entry rescues. Note that for every person that goes down in a confined space, on average nearly three additional people also die in an attempt to rescue the original victim.

Communications Equipment: must be provided to allow communication between attendants and entrants such that the attendant can monitor entrant status and alert entrants if there is a need to evacuate the permit space. Two-way radios would be typical communications equipment.
Personal Protective Equipment (PPE): PPE must be provided as needed for whatever hazards are present for employees conducting entry operations. For example if there is an overhead hazard, hard hats must be provided.

Emergency Planning and Rescue:

Employers must develop and implement procedures for summoning rescue and emergency services, for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized employees from attempting a rescue.

This means that you must coordinate with local emergency responders to determine if they are trained, equipped, and capable of conducting a permit space rescue. If local outside responders are not able to conduct this type of rescue, the employer must develop, train, and equip an internal rescue team.

Non-entry rescues are required whenever they are possible and are facilitated by use of mechanical retrieval systems such as a tripod/winch/harness system to prevent the need for dangerous and technically complex entry rescues.

Web link to full standard or guideline:

Informational resources identified below can also be found on our website at www.mass.gov/dols/eo511.

OSHA Standards:
www.osha.gov, select the "Regulations" tab from the top menu bar. For 1910 standards select the "General Industry" tab. For 1926 standards, select the "Construction" tab. Then, scroll down to find the standard by number.

Permit-Required Confined Spaces: 1910.146

Link to OSHA Confined Spaces page below. This provides links to guidance documents from OSHA and other sources on confined spaces. If this link is outdated, go to www.osha.gov, select "Health and Safety Topics," then select "Confined Spaces."

http://www.osha.gov/SLTC/confinedspaces/index.html